International Journal of Community Medicine and Public Health
Bathija GV et al. Int J Community Med Public Health. 2019 Dec;6(12):5174-5180
http://www.ijcmph.com
pISSN 2394-6032 | eISSN 2394-6040

DOI: http://dx.doi.org/10.18203/2394-6040.ijcmph20195465

Original Research Article

A cross-sectional study on health related behaviors among swimming pool users and sanitary conditions of swimming pools in Hubballi city

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Received: 20 September 2019
Accepted: 11 November 2019

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ABSTRACT

Background: With evolving and advancing civilization, man-made water recreational environments such as swimming pools, not only offer health promotions and social benefits but are also accompanied with health risks. It is necessary to properly manage and consistently monitor swimming pool to make sure about water treatment methods and health, to protect health of the users. This study aimed to assess the health related behaviours in swimming pool users and to study sanitary condition of swimming pool.
Methods: A cross-sectional study done in Hubballi city among swimming pool users. A semi-structured pre-tested self-administered questionnaire applied to 200 participants of 3 swimming pools. Data collected regarding socio-demographic details, swimming pool regulations, health related events and health benefits and sanitary conditions of swimming pool.
Results: Among 200 participants, 65% were males and 35% were females. 78.5% of the participants had knowledge about swimming pool regulation. 68% had unhealthy habits in swimming pool, among these 62% had at least one reported symptom. 73% of males had unhealthy habits and 57% had at least one reported symptom ($p<0.05$ significant). As the experience in swimming increases, unhealthy habits decreases ($p<0.05$ significant) and symptoms will be decreased ($p<0.05$ significant).
Conclusions: In our study majority of the participants had unhealthy habits and knowledge about swimming pool regulations. All swimming pools were chlorinated and pH was maintained within WHO recommended guidelines.

Keywords: Swimming pool, Health related behaviours, Reported symptoms, Unhealthy habits, Sanitary conditions

INTRODUCTION

A swimming pool is a structure filled with water intended for swimming or water based recreation.[1] Swimming pools may be supplied with fresh (surface or ground), marine or thermal water (i.e., from natural hot springs). They may be domestic (private), semi-public (e.g., hotels, schools, health club) or public (e.g., municipal), and they may be supervised or unsupervised. Swimming pools may be located indoors, outdoors or both; they may be heated or unheated.[2]

With evolving and advancing civilization, man-made water recreational environments offer health promotions and social benefits accompanied with increasing comforts and sophisticated services. The recreational facility like swimming pool usage is increased now-a-days, mainly during summer season. Increased usage of this without proper sanitation affects health of users. This can be reduced to a minimum by running the recreational facilities with the application of informed risk management measures.[3]

It is obvious that the use of the swimming pools and similar recreational water environment has benefits of health and well-being. Swimmers adopt healthy behaviours like removing footwear away from the pool, taking pre-swim shower and washing their feet before

entering swimming pool to stay healthy and to avoid contamination of pool.

The following health benefits of swimming are builds endurance and cardiovascular fitness, tones muscles and builds strength, alleviates stress, being relaxing and peaceful form of exercise, improves coordination, balance and posture, improves flexibility, providing a pleasant way to cool down on a hot day, increases your heart rate without stressing your body, helps maintain a healthy weight, healthy heart and lungs, provides an all-over body workout, improves sleep cycle and provides good low-impact therapy for some injuries and condition (arthritis).

However, various studies have reported the chemical, biological, physical contamination in swimming pool which affects the health of swimming pool users. There are many other health risk related to the swimming pool, such as the risk of drowning, trauma and injuries and risk of microbiological, chemical and physical agents.[4]

Although the most important related risks of recreational activities are derived from trauma and injuries, pathogenic microorganism (faecal and non-faecal origin) such as bacteria, protozoa and viruses may also be presented in recreational water.[4] Risk of infection is widely documented in poorly maintained swimming pools and also by unhealthy habits by swimming pool users. This leads to contamination of swimming pool. Failure in disinfection has been recorded as cause of many diseases.[5] Swimming pool diseases are caused by numerous micro-organisms, one can acquire these diseases by swallowing, breathing in mist or aerosols in closed swimming pools have contact with contaminated water in swimming pools.

Illness can also be caused by chemicals in water or chemicals that evaporate from water and cause indoor air problems. There are wide varieties of infections including gastro intestinal, skin, ear, respiratory, eye, neurological and wound infection; of these the most important is diarrhoea.[6]

As health care providers, we may not routinely consider illness associated with recreational water exposure or discuss preventive strategies. Hence, it is necessary to properly manage and consistently monitor swimming pool. From the stand point of health, the physical, chemical and microbial quality of water used in swimming pools should be as desirable and standard as drinking water. Hence, this study was conducted in active swimming pools of Hubballi city during summer. This study aimed to assess the health related behaviours in swimming pool users and to study sanitary condition of swimming pool.

METHODS

A cross-sectional study was conducted among people attending 3 swimming pools in Hubballi city. From previous literature, 80% of the participants follow swimming pool regulations, sample size was calculated.[7] Considering 5% alpha error, 95% confidence interval and 80% power of the test, using following formula sample size found to be 171 and rounded to 200.

$$\sqrt{n} = \frac{1.96\sqrt{pq}}{l}$$

Study sample were selected by convenient method from three swimming pools. Participants who were present at the swimming pool during data collected were included and participants who refused to give consent were excluded from the study. A pre-tested semi-structured questionnaire was used to collect information from the participant who includes two parts.

Part I

Information regarding socio-demographic details, knowledge and practice of swimming pool regulations, health related events and benefits were collected from the participants

Part II

Information regarding maintenance and sanitation among three swimming pools was collected from swimming pool management.

All the three swimming pools are outdoor and public use. Data was collected during summer in the month of May 2019 and June 2019. For the children who were present at the time of study, data collected from their parents. Before collecting data we briefed about the study to the participants and took informed verbal consent. Data was collected from self-administered questionnaire regarding Behaviours and habits in the swimming pool and its maintenance. If the participant had anyone unhealthy behaviour then they were included in those of the unhealthy habits.

Statistical analysis

Data was entered in Microsoft Excel and analysed using statistical package for social science (SPSS) version 21. Continuous data was expressed as mean and standard deviation. Categorical data was expressed as proportions. Chi-square test was used to test the significance of categorical variables. P value of <0.05 was considered significant.

RESULTS

Among 200 participants 65% were males and 35% were females. Majority of the participants were in the age group of 10-20 years (41.5%). Reported symptoms were common among 10-30 years age group and in males. 65% of the participants belong to upper socio-economic status

according to modified B G Prasad classification. 31.5% of the participants use swimming pool at least 1 hour per week and 22.5% of the participants users attend >6 hours per week. 45.5% of the participants were learners or beginners, among them 58% were males and 37% were females.

Reported symptoms were common among learners or beginners. 78.5% of the participants had knowledge of swimming pool regulations, among them 60% were males and 40% females ($p<0.05$) [Table 1].

Table 1: Association between socio-demographic details and reported symptoms.

Socio-demographic details		Reported symptoms by swimmers		Total=200	Chi-square test
		None (n=74)	At least one (n=126)		
Age (in years)	<10	6	10	16	χ^2=4.722; p>0.05
		37.50%	62.50%		
	10 to 20	31	52	83	
		37.30%	62.70%		
	20 to 30	17	43	60	
		28.30%	71.70%		
	30 to 40	9	11	20	
		45.00%	55.00%		
	40 to 50	7	7	14	
		50.00%	50.00%		
	50 to 60	4	3	7	
		57.10%	42.90%		
Gender	Male	58	72	130	χ^2=9.241; p<0.05*
		44.60%	55.40%		
	Female	16	54	70	
		22.90%	77.10%		
Education	Primary or middle school	12	19	31	χ^2=2.381; p>0.05
		38.70%	61.30%		
	High school	12	19	31	
		38.70%	61.30%		
	Pre-university	16	18	34	
		47.10%	52.90%		
	University degree	34	70	104	
		32.70%	67.30%		
Kind of swimmers	Learner or beginner	28	61	89	χ^2=8.588; p<0.05*
		31.50%	68.50%		
	Intermediate	18	41	59	
		30.50%	69.50%		
	Advanced	11	9	20	
		55.00%	45.00%		
	Exercise or practice	17	15	32	
		53.10%	46.90%		
Attendance to swimming pool (in hours)	1	23	40	63	χ^2=2.121; p>0.05
		36.50%	63.50%		
	2-3	9	13	22	
		40.90%	59.10%		
	4-5	9	24	33	
		27.30%	72.70%		
	>6	17	28	45	
		37.80%	62.20%		
	Occasionally	16	21	37	
		43.20%	56.80%		

*: Significant.

Out of 200 participants 73.5% of them leave footwear away from pool, among them 60.5% were males (p<0.05). 84% take pre-swim shower, 82.5% use swimming cap and 47.5% use swimming goggles. Information regarding spit (51), urinate (31) and vomit (4) in swimming pool were asked majority of them found to be males (64.7%, 81% and 100% respectively). Out of 200 participants 4 and 6 of them defecate and throw waste in the swimming pool respectively.

77% of the participants use band aid to cover their wounds before using swimming pool to avoid contamination. 34% of the participants are aware about transmission of infection through swimming pool. If the participant had anyone unhealthy behaviour then they was included in those of the unhealthy habits. According to this we observed 68% of the participants had unhealthy habits, among them majority of them were males which showed statistical significant association (p<0.05).

Table 2: Association between swimming pool and reported symptoms.

Swimming pool	Symptoms		Total	Chi-square test
	None (n=74)	Any one present (n=126)		
Pool 1 M R Academy	33	47	80	χ^2=5.976; p=0.050; Significant
	41.30%	58.80%		
Pool 2 Dennisons	10	36	46	
	21.70%	78.30%		
Pool 3 Shivgiri	31	43	74	
	41.90%	58.10%		

Table 3: Sanitary conditions of swimming pool as given by pool management.

	M R Academy (Pool 1)	Dennisons (Pool 2)	Shivagiri (Pool 3)
Type of pool	Outdoor	Outdoor	Outdoor
Volume of the pool	300000 litres	300000 litres	340000 litres
Type of water	Bore water	Bore water	Corporation water
Type of admissions	Semi-Public	Semi-public	Semi-Public
Supervision	Yes	Yes	Yes
Frequency of changing water	3months	Every month	6months
Method of disinfection	Salt-water chlorination	Chlorination	Chlorination
Frequency of disinfection	7 days	Depends on use	Weekly
Method of chlorination	Powder	Liquid	Powder and gas (auto)
Auto filters	Present	Present	Present
Wardrobe for each swimmers	Absent	Present	Absent
Displayed rules and regulations	Yes	Yes	Yes
Rules followed by swimmers	Regularly	Regularly	Regularly
Adherence to swimming load	Yes	Yes	Yes
Number of swimmers per day	>40	<40	>40
Frequency of testing water	3 days once	Weekly	Daily
pH of pool water	Not mentioned	7.2-7.4	7.5

Users of swimming pool 2 users were having majority of reported symptoms [Table 2]. Data regarding the maintenance of swimming pool was collected by management showed that three swimming pools situated outdoor and semi-public type. Pool 1 and 2 uses Bore water and pool 3 uses corporation water. Frequencies of change in water every 3months, every month and every 6months for pool 1, 2 and 3 respectively. All three swimming pools chlorinate with chlorine powder every week by pool 1 and 3. Pool 2 chlorinates depending on usage of pool. Auto filters were present in all pools. Swimming pool load of pool 1 and 3 was >40 persons per day and for pool 2 was <40 persons per day. These three swimming pool check pH once in 3 day, weekly and daily by pool 1, 2 and 3 respectively and maintained according to WHO standards [Table 3].

DISCUSSION

Socio-demographic details

There are 200 participants in our study, among them 41.5% were in the age group of 10-20 years and 8% were in the age group of <10 years. In other study done by Galle et al in Italy showed that 184 were adults and 184 were children and adolescents, among them the mean age

of children was 7.9 years and for adults the mean age was 43 years.[7]

In our study 65% of the participants were male and 35% were female. 52% participants were university degree students. 66.5% participants belong to upper socioeconomic class according to modified B G Prasad classification. In other study done by Galle et al in Italy showed that among children and adults, female participants were in higher proportion. The most common educational level among the parents was university degree.[7]

In our study 31.5% and 22.5% of the participants attend swimming pool 1 hour and >6 hours per week respectively. Among the males (130), 40% of participants were learner or beginner, 16% of participants attend swimming pool for exercise. Among females (70), 53% of participants were learner or beginner and 16% of participants attend swimming pool for exercise.

Behaviors of swimming pool users

In our study, 73.5%, 84% and 88% participants remove footwear away from the pool, take pre-swim shower and wash their feet before entering swimming pool respectively. In similar study done by Galle et al in Italy showed that 86.4% and 85.2% of the children and 69% of the adults take pre-swim shower and leave footwear away from swimming pool respectively.[7] Similar study done by Momas et al in Paris shows that, 96.4% of children take bath before entering swimming pool.[8]

Swimming pool regulations

In our study among males (130), 72.3% know about swimming pool regulations and among females (70), 90% of the participants know about swimming pool regulations. In study done by Galle et al in Italy showed that 80% of participants know about swimming pool regulations.[7]

In our study 82.5% and 47.5% of the participants used swimming cap and goggles respectively. Similar study done by Momas et al in Paris showed that 18.6% and 68.5% of the participants used swimming cap and goggles respectively.[8]

In our study 41% and 25% of participants do not have knowledge and don't know about infections transmitted through swimming pools.

Reported symptoms

In our study among symptoms most of them reported sore throat, cough, headache, burning sensation in eyes, irritation in eyes, generalized itch, tinnitus and generalized body ache. Similar study done by Galle et al in Italy showed that most frequent symptoms were rhinitis, eye complaints, skin infections and generalized itch.[7] Similar study done by Momas et al in Paris showed that among participants (210), 23.3% reported generalized itch, 10% cough, 25% fatigue, 36.5% running nose 15.8% watering of eyes.[8]

In our study most of the reported symptoms are in the age group of 10-30 years. Among them 53% were males and 47% were females and shows statistical significant association (p=0.003). This study shows as a frequency of using swimming pool increases reported symptoms will be reduced and shows statistical significant association (p=0.035). This could be due to the frequency of using pool increases knowledge regarding pool regulations increased.

In our study, most of the participants who reported symptoms were from pool 1 (37.3%) and pool 3 (34%). Our study shows among unhealthy habits in swimming pool, 62.5% reported at least one symptom.

Health benefits

In our study most of the male participants had better knowledge than females regarding health benefits by swimming pool.

In our study healthy habits in swimming pool is more in 10-20 years of age group. As we conducted this study during summer season most of the participants were children who were attending summer camp. 53% of females have healthy habits in swimming pool than in males (46.8%). It shows statistical significant association between gender and healthy habits (p=0.000).

Management

In our study, 3 outdoor, semi-public and supervised swimming pools were surveyed. Out of which two pools uses bore water and third pool uses corporation water. The frequency of changing water is every month, once in three months and once in 6 months in Pool 2, pool 1 and pool 3 respectively. All the three pools use chlorination as the method of disinfection and have auto-filters installed. Frequency of disinfection depends on use in pool 2 and done weekly in other two pools. All the 3 pools have displayed rules and regulations to be followed and maintain the adherence to swimming load. The frequency of testing water is once in 3 days, weekly and daily in Pool 1, 2 and 3 respectively. The pH of pool water is 7.2-7.4 in pool 2 and 7.5 in pool 3, both of which are within the WHO guidelines (pH=7.2-7.8). Most of the pool (66.6%) had a number of swimmers, at the time of data collection, >40 persons.

Similar study done by Rabi et al in Amman, Jordan; 60% of swimming pools were outdoor, 79% of the pools were disinfected by chlorination (chlorine powder), guidance board were available in 72% of pools and adherence to bathing load were followed in 71% of the pool. Most of the pool (66.6%) had a number of swimmers, at the time

of data collection, >20 persons. None of the surveyed swimming pools was in full compliance with the Jordanian standards for swimming pool water.[5]

As there are fewer studies regarding health related events in swimming pool in India we wound recommend focusing in this aspect so as to create awareness among swimming pool users regarding transmission of infection through pool and adequate knowledge regarding maintenance of sanitary conditions of pool. This study has certain limitation, majority of the participants were beginners or learners we could not assess adherence of pool regulations. As district laboratory refused to check water samples, we could not check physical and chemical fitness of water.

CONCLUSION

In this study most of the swimming pool users were aware about swimming pool regulations. Majority of them were having healthy habits in swimming pool. Respiratory symptoms and symptoms related to eye were more commonly reported by swimming pool users. All the pools maintain the sanitation by proper chlorination. All pools check pH regularly and maintain pH within WHO recommended standards.

ACKNOWLEDGEMENTS

The authors thank all the participants and swimming pool management for their kind co-operation in this study.

Funding: No funding sources
Conflict of interest: None declared
Ethical approval: The study was approved by the Institutional Ethics Committee

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Cite this article as: Bathija GV, Narasimha R. A cross-sectional study on health related behaviors among swimming pool users and sanitary conditions of swimming pools in Hubballi city. Int J Community Med Public Health 2019;6:5174-80.